

REMARKS

Claims 1-10 are pending in this application. Claim 1 is independent. No claims are amended. In light of the below remarks, favorable reconsideration and allowance of the present application are respectfully requested.

Rejections Under 35 U.S.C. § 103 – HATANO

Claims 1-10 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,740,192 (“*Hatano*”). This rejection is respectfully traversed.

The Examiner alleges *Hatano* obviates claim 1, cites Examples II-9, II-10, and II-11 (FIGS. 12, 13, and 14, respectively) of *Hatano*, and specifically asserts that *Hatano* teaches “growing a first (Al,Ga)N layer over a substrate at the first substrate temperature by MBE using ammonia as the nitrogen precursor,” “growing an (In,Ga)N quantum well structure over the first (Al,Ga)N layer by MBE using ammonia as the nitrogen precursor,” and “growing a second (Al,Ga)N layer over the quantum well structure at the third substrate temperature by MBE using ammonia as the nitrogen precursor” as recited by claim 1. However, the Examiner notes that *Hatano* fails to explicitly teach growing these layers by the MBE process, and refers to column 18, lines 21-27 of *Hatano*, where *Hatano* states “In the above examples, the MOCVD method was employed for effecting crystal growth, a molecular beam epitaxy method (MBE) method...may be employed.” (*Office Action*, pages 3-4).

Applicants respectfully traverse the rejection of claim 1 on two grounds. First, Applicants submit that, because Examples II-9, II-10, and II-11 of *Hatano* appear below the statement “In the above examples, the MOCVD method was employed for effecting crystal growth, a molecular beam epitaxy method (MBE) method or a source material transportation method using a chlorine gas may be employed,” this statement does not apply to Examples II-9, II-10, and II-11, and thus *Hatano* fails to teach or suggest that MBE may be used in the examples the Examiner cites to obviate the aforementioned limitations of claim 1.

Secondly, assuming *arguendo* that *Hatano* does teach the use of MBE as alleged by the Examiner (which Applicants do not admit), Applicant submit that *Hatano* still fails to teach or suggest that the MBE method will be performed using the same temperatures as the MOCVD method, and therefore *Hatano* cannot teach or suggest the method of claim 1.

Applicants submit that a person skilled in the art would understand that the MBE method and the MOCVD method are entirely different methods, and that temperatures suitable for the MOCVD method are not necessarily suitable for the MBE method.

Further, as detailed in the disclosure, in a conventional application of the MBE process, there is difficulty achieving a high growth temperature. Therefore, only a temperature in the range of about 570-620°C is obtained because the flux of ammonia to the growth chamber was low, leading to a low V/III ratio. Due to the low growing temperature, the quality of the InGaN layers is much lower than the quality of InGaN layers grown by MOCVD. (*Disclosure*, page 6, lines 6-12).

According to the disclosure, by achieving a V/III ratio of more than 10:1, and preferably of more than 500:1, during the growth process an InGaN nitride semiconductor layer is allowed to be grown “at temperatures well above those used in prior art MBE methods.” (*Disclosure*, page 23, lines 11-16 and page 26, lines 1-10). Therefore, example embodiments could grow at the first (Al, Ga)N layer at a first temperature (850-1050°C), grow the (In, Ga)N quantum well structure at a second temperature (650-1000°C) and grow the second (Al, Ga)N layer at a third temperature (850-1000°C), the temperatures of which are chosen as desirable for the respective layers’ growth and the temperature of which exceeds the temperature range achieved in conventional MBE methods.

Applicants submit that the only example of MBE allegedly taught in *Hatano* is Example II-4, in which the substrate 71 is “kept at a temperature of 650°C” where the deposition of semiconductor layers are performed on the substrate 71. (*Hatano*, col. 14, lines 15-31). Therefore, although *Hatano* allegedly teaches growing the layers at three temperatures using the MOCVD method, it appears that when the MBE method is applied, the problem of a low MBE growth temperature remains unsolved where the growth temperature of *Hatano* by MBE process still has to be kept at 650°C.

Accordingly, Applicants submit that one skilled in the art would consider the MBE method of *Hatano* in the category of the conventional methods discussed in the disclosure. Applicants further submit that by changing the MOCVD method with the conventional MBE method taught by *Hatano*, Hatano cannot teach or suggest a method including a “first substrate temperature,” a “second substrate temperature,” and a “third substrate temperature” as recited by

claim 1, and thus may suffer from similar poor material quality as other conventional MBE methods.

For at least these reasons, Applicants submit that *Hatano* fails to teach or suggest all features of claim 1, and therefore respectfully request that the rejection of claim 1 be withdrawn. Applicants further request that the rejections of claims 2-10 also be withdrawn, at least by virtue of their dependency upon claim 1.

### CONCLUSION

In view of the above remarks and amendments, Applicants respectfully submit that each of the rejections has been addressed and overcome, placing the present application in condition for allowance. A notice to that effect is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to contact the undersigned.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Donald J. Daley, Reg. No. 34,313 at the telephone number of the undersigned below.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 08-0750 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,  
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